

Harvest Estimates for Selected Enhanced Roadside Sport Fisheries Near Juneau, Alaska, During 1991

by

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and
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Alaska Department of Fish and Game

Division of Sport Fish



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ABSTRACT

Angler effort and harvest was estimated for selected Juneau roadside sport fisheries enhanced by local hatchery stocks during 1991. Surveys were initiated on 24 June and continued through 27 October, although some of the sites were surveyed for only a portion of this time period. The contributions of hatchery chinook salmon *Oncorhynchus tshawytscha* and coho salmon *Oncorhynchus kisutch* to the fisheries by coded-wire tag lot were estimated.

A total of 282 (SE = 53) large chinook salmon at least 28 inches (71 cm) in total length and 180 (SE = 36) small chinook salmon (<28 inches in length) were harvested at Fish Creek, Auke Creek mouth, or Auke Bay docks. Total catch of chinook salmon at these three sites was 380 (SE = 66) large fish and 320 (SE = 76) small fish. An estimated 344 (SE = 79) of the chinook salmon harvested at these three sites were of hatchery origin. Most of these chinook salmon originated at Snettisham hatchery from releases in 1987, 1988, or 1989.

The contribution of selected 1990 releases of hatchery coho salmon sport fisheries at Fish Creek, Mendenhall Ponds, and Montana Creek mouth was also evaluated. An estimated 1,407 (SE = 143) hatchery coho salmon contributed to the total harvest of 1,959 large coho salmon (at least 16 inches in length) and 382 jack coho salmon (<16 inches in length) at these three sites. The total catch of coho salmon at these three sites was 2,920 (SE = 349) large fish and 614 (SE = 212) jack coho salmon. The most successful stocking was of summer-run coho salmon into Fish Creek during 1990.

Additional harvests of hatchery chinook and coho salmon from roadside releases were also taken by Juneau boat anglers, and some of the hatchery releases were evaluated by examining contributions to both roadside and boat sport fisheries over the past few years.

KEY WORDS: Creel survey, angler effort and harvest, sport fishery, hatchery, enhancement, coded-wire tag, chinook salmon, *Oncorhynchus tshawytscha*, coho salmon, *Oncorhynchus kisutch*, Juneau, Southeast Alaska.

INTRODUCTION

The marine and fresh waters of Southeast Alaska support important commercial, sport, and subsistence fisheries for a variety of salmonid, bottomfish, and shellfish species. Boat sport fisheries in salt water for chinook *Oncorhynchus tshawytscha* and coho salmon *O. kisutch* are the largest sport fisheries in the region, however, freshwater and saltwater fisheries accessed from the roadside are also significant. In 1990, about 5,723 angler days of freshwater sport fishing effort occurred on the Juneau roadside (Mills 1991). Additionally, about 34% (17,752 angler days) of the total saltwater shoreline effort expended in southeast Alaska (52,396 angler days) occurred on the Juneau roadside.

Hatchery chinook and coho salmon have been released at a number of sites along the Juneau roadside (Figure 1). Evaluations of angler effort and success at enhancement sites are necessary to determine the success of hatchery releases in producing local roadside fisheries for chinook salmon and improving roadside fisheries for coho salmon. Besides returning to the terminal harvest areas, some of these fish are also harvested in the Juneau marine boat sport fishery as well as in commercial fisheries. Once the sport fishery contributions from different releases are known, resources may be directed to developing those brood stocks, imprinting and rearing strategies, and release sites that are most cost effective in enhancing sport fisheries. Only selected Juneau roadside fisheries that have been enhanced were surveyed in 1991, as this was the fourth year of an ongoing study to evaluate enhancement programs.

Chinook salmon enhancement efforts on the Juneau roadside during the past five years have been extensive and this program is expected to continue (Table 1). The purpose of the chinook salmon releases has been to create roadside fishing opportunities for chinook salmon, as no natural runs of chinook salmon occur in streams along the Juneau road system. Evaluations of sport fisheries at release sites during 1989 and 1990 have indicated that roadside anglers were most successful at catching hatchery chinook salmon near the Auke Creek mouth and Fish Creek release sites (Suchanek and Bingham 1990a, 1991a). These studies also indicated that anglers had little or no success taking hatchery chinook salmon at the Sheep Creek and Montana Creek release sites. For this reason, only the sport fisheries at Fish Creek, Auke Creek mouth, and Auke Bay docks were evaluated during 1991.

Although coho salmon enhancement has also been extensive in the Juneau area over the past few years (Table 2), 1991 was the last year that coho salmon returned from Federal Aid projects as Snettisham hatchery no longer rears coho salmon. Coho salmon have been stocked to supplement the relatively limited wild runs of coho which occur along the roadside as they are inadequate to supply the sport fishing demand for coho salmon fishing opportunities. About one million coho salmon smolts were released in both 1990 and 1991 by Douglas Island Pink and Chum (a local private non-profit hatchery) (Table 2), but roadside returns from these releases were not evaluated in 1991 since the releases were not federally funded.

Of primary interest in the 1991 coho salmon evaluations were returns from an early run stock of Pavlof River coho salmon. These coho salmon were reared at Snettisham, released at Fish Creek, and produced large numbers of "jack" (<16 inches in length) coho salmon for roadside sport anglers in 1990 (Suchanek and Bingham 1991a). Hatchery coho salmon raised at Snettisham also returned to Mendenhall Ponds in 1991, and contributions to this sport fishery were evaluated. Fish Creek has an escapement of <100 wild coho salmon, while Mendenhall ponds

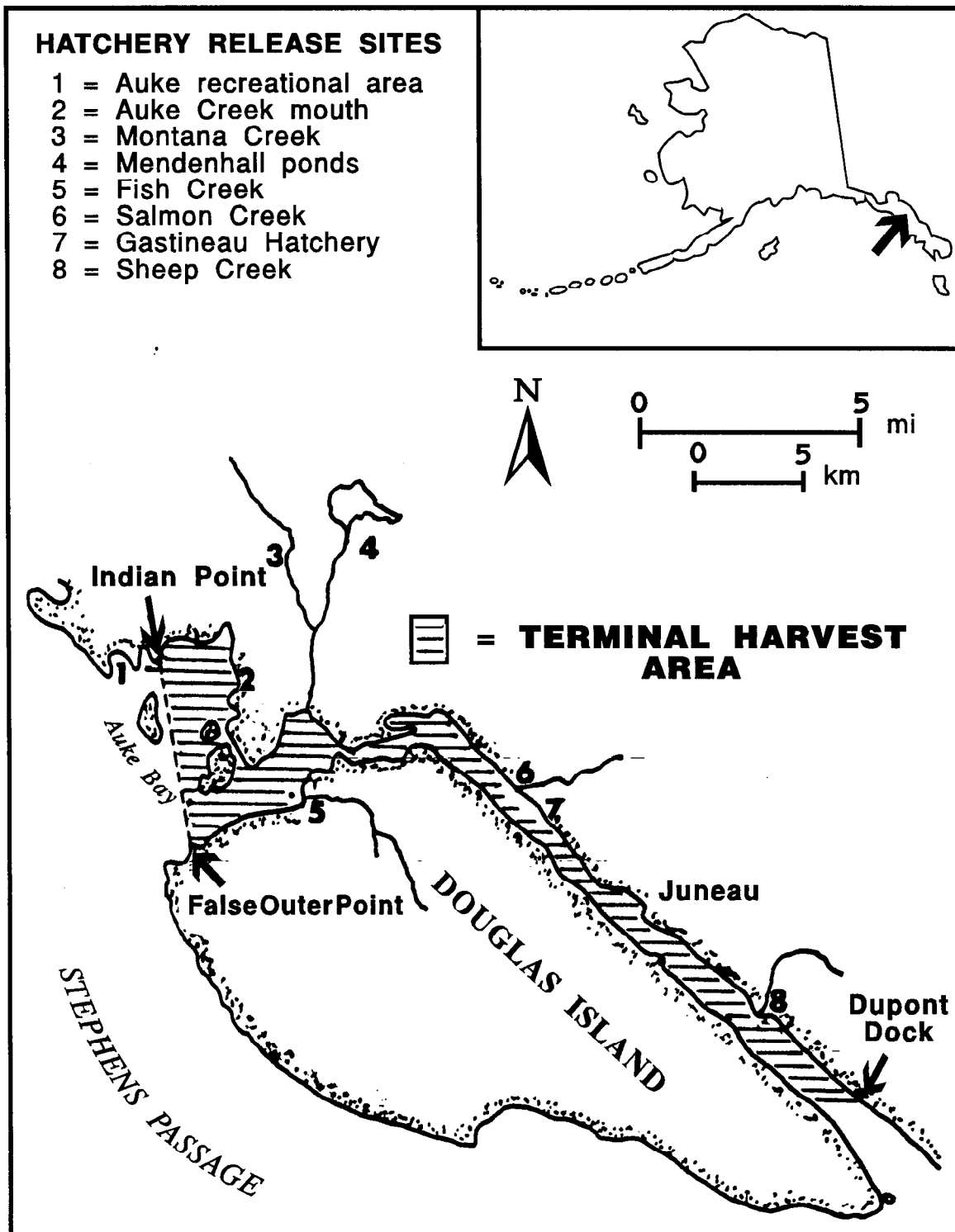


Figure 1. Hatchery release sites for chinook and coho salmon on the Juneau roadside during 1987-1991 and the terminal harvest area opened to increased chinook salmon bag limits during 1989-1991.

Table 1. Summary of hatchery-reared chinook salmon smolts released in the Juneau sport fishery enhancement program, 1987-1991. All of the fish have been reared at Snettisham hatchery, with the exception of the 1991 release at Gastineau Hatchery by Douglas Island Pink and Chum. This table does not include 1990 and 1991 releases of chinook salmon smolts into Twin Lakes. Not all of the fish released were tagged.

Site	Release strategy ^a	1987 Number (tag code)	1988 Number (tag code)	1989 Number (tag code)	1990 Number (tag code)	1991 Number (tag code)
Montana Creek	DIR	30,703 (4-27-45)	52,000 (4-26-12)	10,000 (4-31-34) 23,000 (4-31-58)	0 0	0 0
Fish Creek	DIR	31,479 (4-27-42)	0	0	0	0
	IMP	31,205 (4-27-44)	74,000 (4-30-01)	67,000 (4-31-60)	99,697 (4-33-60)	26,273 (4-31-50)
	IMP				49,775 (4-33-43)	30,785 (4-34-02)
	IMP					40,975 (4-35-61)
	IMP					14,415 (4-35-62)
	IMP					37,798 (4-36-01)
Auke Creek mouth	DIR	50,522 (4-27-43)	0	0	0	0
	RET	15,038 (4-27-50)	46,000 (4-29-62)	0	0	0
	IMP	24,972 (4-27-46)	46,000 (4-29-61)	117,000 (4-32-01)	144,609 (4-34-15)	15,188 (4-31-48)
	IMP				30,732 (4-33-41)	36,966 (4-33-62)
	IMP					30,764 (4-34-01)
	IMP					64,137 (4-34-03)
Sheep Creek mouth	IMP	31,112 (4-27-48)	31,556 (4-30-02)	43,000 (4-31-61)	101,847 (4-34-10)	32,355 (4-33-08)
	IMP			77,000 (4-31-62)	20,308 (4-33-42)	68,188 (4-34-04)
Gastineau Hatchery	IMP	0	0	11,000 (4-31-36)	32,481 (4-33-44)	43,595 (4-36-09) ^b
	IMP				68,981 (4-33-56)	0
Totals		215,031	249,556	348,000	548,430	441,439

^a DIR = direct release; RET = retained and fed; IMP = retained, fed, and imprinted.

^b Reared by Douglas Island Pink and Chum.

Table 2. Summary of hatchery-reared coho salmon smolts released in the Juneau sport fishery enhancement program, 1987-1991. All of the releases have been reared at the Snettisham or Douglas Island Pink and Chum (DIPAC) hatcheries. This table does not include releases of coho salmon into Twin Lakes. Not all of the fish released were tagged.

Site	Release strategy ^a	1987 Number (tag code)	1988 Number (tag code)	1989 Number (tag code)	1990 Number (tag code)	1991 Number (tag code)
Salmon Creek	IMP	101,000 (4-27-28)	0	0	0	0
Fish Creek	IMP	53,000 (4-27-29)	50,000 (4-29-48)	42,000 (4-31-53)	20,376 (4-32-35)	0
	IMP				20,860 (4-29-53) ^b	0
	IMP				6,420 (4-31-46) ^b	0
Sheep Creek	RET	39,442 (4-28-20)	100,000 (4-29-47)	44,940 (4-31-54)	182,006 (4-34-19) ^c	167,963 (4-36-10) ^c
	RET				175,936 (4-34-22) ^c	170,546 (4-36-11) ^c
	RET				175,270 (4-34-23) ^c	166,778 (4-36-12) ^c
Mendenhall Ponds	DIR	53,000 (4-27-30)	50,000 (4-29-49)	37,000 (4-31-55)	25,843 (4-32-37)	0
					100,763 (4-32-36) ^d	0
Gastineau Hatchery	IMP	0	49,659 (4-30-15) ^c	37,000 (4-32-31) ^c	182,874 (4-34-20) ^c	169,436 (4-36-13) ^c
	IMP				184,391 (4-34-21) ^c	169,028 (4-36-14) ^c
	IMP				179,001 (4-34-24) ^c	169,355 (4-36-15) ^c
Auke Recreational Area	IMP	0	18,896 (4-30-14) ^c	0	0	0
Totals		246,442	268,555	160,940	1,253,740	1,013,106

^a DIR = direct release; RET = retained and fed; IMP = retained, fed, and imprinted.

^b Pavlof early run stock.

^c Reared by Douglas Island Pink and Chum (DIPAC).

^d Fry release by DIPAC on 18 December 1989.

has a natural escapement of perhaps 200 to 500 fish (M. Bethers, Area Management Biologist, Alaska Department of Fish and Game, Juneau). Suchanek and Bingham (1991a) also reported that about 18% of the coho salmon taken at the mouth of Montana Creek were hatchery coho salmon released at Mendenhall Ponds. For this reason, the hatchery contribution of coho salmon to the fishery at the mouth of Montana Creek was also evaluated in 1991.

To provide for harvest of returning hatchery chinook salmon, Juneau roadside streams were opened to the harvest of chinook salmon by emergency order from 1 June to 30 September 1991. An emergency order was necessary since all freshwater streams in Southeast Alaska are closed by regulation to the harvest of chinook salmon. A terminal harvest area in salt water was also opened by emergency order to the taking of small (<28 inches or 71 cm in total length) chinook salmon from 1 June through 30 September (Figure 1). An emergency order was again necessary since by regulation the minimum size limit for chinook salmon in Southeast Alaska salt waters is 28 inches with a two fish bag limit. The terminal area encompassed Gastineau Channel north and west of a line at the latitude of Dupont dock, and Fritz Cove and Auke Bay east of a line from False Outer Point to Indian Point. This area was opened to provide for harvest of mature small chinook salmon by both shoreline and boat anglers. The bag and possession limit for chinook salmon in Juneau roadside streams and the terminal harvest area was 2 large (at least 28 inches in total length) fish and 2 small fish.

The bag limit for coho salmon 16 inches (41 cm) or more in length in saltwater areas was 6 fish per day and 12 in possession, while freshwater anglers were limited to 2 fish per day, 2 in possession. An additional 10 coho salmon <16 inches in length could be taken in both fresh and salt water.

This report presents harvest estimates for selected roadside sport fisheries and also evaluates selected releases of hatchery fish on the Juneau roadside as to their effectiveness in contributing to both marine and roadside sport fisheries in the local area. The specific objectives for the 1991 Juneau roadside harvest surveys were to estimate on a weekly basis:

1. Total angler effort and harvest of hatchery produced chinook salmon by coded wire tag code in terminal harvest areas at Auke Creek mouth and the nearby Auke Bay floats and in Fish Creek from 24 June to 8 September 1991 for the peak of the fishing day.
2. Total angler effort and harvest of hatchery produced coho salmon by coded wire tag code in terminal harvest areas at Fish Creek and the mouth of Montana Creek from 9 September to 27 October 1991 and at Mendenhall Ponds from 16 September to 27 October 1991 for the peak of the fishing day.

METHODS

Study Design

A roving type of creel survey (Neuhold and Lu 1957) was used to estimate angler effort and harvest at the sites. Sampling effort at the sites was limited to periods when chinook and coho salmon were expected to return to the sites and be available to anglers. Site descriptions for each of the locations surveyed can be found in Appendix A1.

The creel survey season extended from 24 June through 27 October 1991. The season was divided into weekly periods which began on Mondays and ended on Sundays. Within each weekly period, all days were classified as either weekdays or weekend/holidays (all Saturdays, Sundays, and the dates of 4 July and 2 September). Sampling was split, approximately 50% to weekdays and 50% to weekend/holidays, to approximate the relative amount of angling effort occurring at these times. Some switching of selected weekdays sampled was done to assure two consecutive days off for staff every week.

Only the peak period of each fishing day was surveyed, since our primary interest was to estimate the contribution of various hatchery releases at the selected sites. The relative contribution of each release code was assumed to be the same during the hours of the fishing day not sampled. Three systematically scheduled angler counts were conducted each day at each site during the "peak" of each fishing day, and were considered to be instantaneous and reflect fishing effort at the time of the count. Effort was estimated by multiplying the average angler count for the day for each site by the hours available for sampling in the peak of the fishing day.

Completed-trip and uncompleted-trip angler interviews were collected both during the angler counts and between each scheduled count during the sampling day. At the beginning of the season, a voluntary return card was given to each uncompleted-trip angler interviewed in an attempt to collect completed-trip information from these anglers. Since return rates for these cards were so low, it was probable that the data were potentially highly biased, and data from returned cards were not used. The catch per unit effort (CPUE) and harvest per unit effort (HPUE) for each species of fish was estimated from both the completed-trip and uncompleted-trip angler interviews. The estimated catch or harvest was then obtained from the product of the effort and CPUE or HPUE estimates.

The design of the roving creel survey was of the stratified two-stage sample survey type. The strata were defined by 7-day periods (Monday-Sunday) and by type of day within each 7-day period: weekdays and weekend-holidays.

During each stratum two days were selected at random without replacement from the available days (accordingly, all weekend/holidays were surveyed during most 7-day periods). Days represent the first stage sampling units in this two-stage design.

During the chinook salmon creel survey period, an angler count and interviews at all three sites combined were expected to take approximately two hours to complete for each circuit. Within each sampled day three systematically arranged angler counts were scheduled. The sampling day was defined as the peak hours of 0800 to 2000, accordingly, there were two possible combinations of three-each systematically arranged two hour counts: (1) 0800, 1200, and 1600; and (2) 1000, 1400, and 1800. The count combination conducted during each day was selected at random. The starting site for counts in the circuit was selected at random for each day (and remained the same for the day). Angler interviews and counts were conducted concurrently during the circuit (as noted above), with the restriction that the circuit count be completed within the allotted time. After arriving at each site, during the combination count/interview periods, the technician either counted anglers first or interviewed anglers first as selected at random for each day. The two possible count combinations represented our second stage sampling units for the estimation of angler effort.

During the 9-15 September portion of the coho salmon creel survey, the definition of the sampling day and the length of each angler count was the same as during the chinook salmon creel surveys. As such, the possible count times were the same for this period of the survey. After 15 September, the angler count circuit was expected to take at least 3 hours to complete. Additionally, the definition of the sampling day changed as the hours of daylight decreased near the end of the season. From 16 September to 6 October, the sampling day ran from 0800 to 1900, and the circuits began at 0800, 1140, and 1520. From 7 to 27 October, the sampling day ran from 0800 to 1800, and the circuits began at 0800, 1120, and 1440.

Anglers interviewed at each site represented the second stage sample units for estimation of CPUE and HPUE and were expanded to obtain catch and harvest estimates.

Data Collection

Individual anglers were asked the number of hours fished, whether the trip was complete or incomplete, and the number of each fish species that were taken and released. Chinook salmon <28 inches (71 cm) in total length were categorized as small chinook salmon. Chinook salmon at least 28 inches in length were categorized as large chinook salmon. Similarly, coho salmon <16 inches (41 cm) in total length were called jack coho salmon, while those ≥ 16 inches in length were called large coho salmon. The target for each angler was also recorded as either chinook salmon, salmon other than chinook, Dolly Varden *Salvelinus malma*, cutthroat trout *Oncorhynchus clarki*, or bottomfish (Pacific halibut *Hippoglossus stenolepis*, other flatfish, etc). Voluntary postal return cards were handed out to uncompleted-trip anglers in an attempt to collect completed-trip information.

An instantaneous count of the number of anglers fishing in an area was also recorded. For each sample, counts were conducted either before or after interviews as determined on a random basis. Harvested chinook and coho salmon were also inspected for missing adipose fins.

Harvest Estimate Data Analysis

Angler effort (in angler-hours) and estimates of total catch and harvest of chinook or coho salmon (and other incidental fish species), the associated variances and standard errors were estimated according to the procedures outlined below. A systematic-random estimator was used to estimate angler effort on a sample by sample basis (each day sampled). Catch and harvest estimates for each sample were obtained by a ratio estimator: by combining the estimated effort (for the sample) with estimates of catch per unit effort (CPUE) and harvest per unit effort (HPUE) obtained from the angler interviews. Angler counts were considered instantaneous and reflected fishing effort at the time of the count. Effort was estimated by multiplying the average count by the fishery hours available in the time periods associated with the counts to obtain effort in angler-hours. The CPUE and HPUE for each species of fish was estimated from angler interview data. The estimated catch and harvest was obtained from the product of the effort and the CPUE and HPUE estimates.

The jackknife estimation approach was used to obtain the CPUE and HPUE estimates, because most other estimators were known to be biased (for use as ratio estimators). The jackknife estimator has been shown to be less biased, and procedures exist for correcting some of this bias (see Cochran 1977, section 6.15, pages 174-177; and Smith 1980).

The individual sample estimates of effort, catch, and harvest were used in a stratified two-stage estimation procedure to obtain total estimates, both within strata and across strata.

First, the individual jackknifed HPUE (or CPUE) was calculated for each interviewed angler in each sample:

$$HPUE_{hik}^* = \frac{\sum_{o=1}^{m_{hi}} h_{hio}}{\sum_{o=1}^{m_{hi}} e_{hio}} \quad (1)$$

where h_{hio} and e_{hio} = harvest and effort, respectively, of each interviewed angler, and m_{hi} = number of interviewed anglers in each sampled day.

The jackknife mean HPUE for each sampled day within each stratum was then obtained as

$$\overline{HPUE}_{hi}^* = \frac{\sum_{k=1}^{m_{hi}} HPUE_{hik}^*}{m_{hi}} \quad (2)$$

The bias correction (adapted from Efron 1982, equation 2.8, page 6) was then performed (unless it resulted in a negative value, in which case the uncorrected jackknife statistic was used):

$$\overline{HPUE}_{hi}^{*†} = [m_{hi} (\overline{HPUE}_{hi} - \overline{HPUE}_{hi}^*)] + [\overline{HPUE}_{hi}^*] \quad (3)$$

where

$$\overline{HPUE}_{hi} = \frac{\sum_{o=1}^{m_{hi}} h_{hio}}{\sum_{o=1}^{m_{hi}} e_{hio}} \quad (4)$$

The jackknife mean was then expanded by the estimated angler effort for the sampled day to obtain the estimated harvest for each sampled day:

$$\hat{H}_{hi} = \hat{E}_{hi} \overline{HPUE}_{hi}^* \quad (5)$$

where \hat{E}_{hi} = estimated angler effort for each sampled day, obtained by

$$\hat{E}_{hi} = T_{hi} \bar{x}_{hi} \quad (6)$$

\bar{x}_{hi} = the mean angler count for each day, obtained by

$$\bar{x}_{hi} = \frac{\sum_{q=1}^{r_{hi}} x_{hiq}}{r_{hi}} \quad (7)$$

T_{hi} = the number of hours in each sampled day,

r_{hi} = the total number of angler counts conducted for each sampled day (set to 3 as per schedule), and

x_{hiq} = the number of anglers counted fishing during each count within each sampled day.

The catch for the sampled day was estimated similarly by substituting the appropriate harvest statistics into equations (1) to (5).

Estimates of angler effort, catch, and harvest for each stratum were obtained by first estimating the mean stratum value (where \bar{Y}_h is the mean of the sampled day estimates, and Y represents E, C, or H-effort, catch, and harvest, respectively):

$$\bar{Y}_h = \frac{\sum_{i=1}^{d_h} \hat{Y}_{hi}}{d_h} \quad (8)$$

where \hat{Y}_{hi} = the estimated sample value for effort [E, as obtained from equation (6), above], catch or harvest [C or H, as obtained from equation (5), above].

Then the estimated stratum effort, catch, and harvest was obtained by expanding by the number of days in each stratum:

$$\hat{Y}_h = D_h \bar{Y}_h \quad (9)$$

where D_h = the number of days in each stratum.

The variance of the estimated harvest for each stratum was obtained by the two-stage variance equation (following the approach outlined by Cochran 1977), omitting the finite population correction factor (fpc) for the second stage units:

$$\hat{V}[\hat{H}_h] = \left\{ (1 - f_{1h}) \frac{D_h^2}{d_h} S_{1h}^2 \right\} + \left\{ f_{1h} \frac{D_h^2}{d_h^2} \sum_{i=1}^{d_h} \hat{V}[\hat{H}_{hi}] \right\} \quad (10)$$

where f_{1h} = the first stage sampling fraction (i.e., $f_{1h} = d_h / D_h$),

S_{1h}^2 = the among-day variance for the total harvest estimate observed over all days sampled, obtained by

$$S_{1h}^2 = \frac{\sum_{i=1}^{d_h} (\hat{H}_{hi} - \bar{\hat{H}}_h)^2}{d_h - 1} \quad (11)$$

$\hat{V}[\hat{H}_{hi}]$ = variance for the harvest estimate for each sampled day, obtained by Goodman's (1960) formula for the variance of a product of random variates:

$$\hat{V}[\hat{H}_{hi}] = \hat{E}_{hi}^2 S_{2hi}^{*2} + (\overline{HPUE}_{hi}^*)^2 \hat{V}[\hat{E}_{hi}] - S_{2hi}^{*2} \hat{V}[\hat{E}_{hi}] \quad (12)$$

S_{2hi}^{*2} = the jackknife estimate of variance for the jackknifed sample mean HPUE (adapted from Efron 1982, equation 3.2, page 13):

$$S_{2hi}^{*2} = \frac{(m_{hi} - 1)}{m_{hi}} \sum_{k=1}^{m_{hi}} (HPUE_{hik}^* - \overline{HPUE}_{hi}^*)^2 \quad (13)$$

and $\hat{V}[\hat{E}_{hi}]$ = estimated variance of the angler effort estimate for each sampled day, obtained by using the successive differences formula appropriate for systematic samples (adapted from Wolter 1985, equation 7.2.4, page 251):

$$\hat{V}[\hat{E}_{hi}] = \frac{T_{hi}^2}{r_{hi}} \frac{\sum_{q=2}^{r_{hi}} \{X_{hiq} - X_{hi(q-1)}\}^2}{2(r_{hi} - 1)} \quad (14)$$

Variance estimates for the estimated catch were obtained by replacing the appropriate catch statistics (c's and H's) for the harvest statistics (h's and H's) in equations (10) through (13).

Stratum estimates of the variance of the angler effort were obtained in a similar manner to those for catch and harvest. The primary difference occurs in the second major term in equation (10):

$$\hat{V}[\hat{E}_h] = \left\{ (1 - f_{1h}) \frac{D_h^2}{d_h} S_{1h}^2 \right\} + \left\{ f_{1h} \frac{D_h^2}{d_h} \sum_{i=1}^{d_h} \hat{V}[\hat{E}_{hi}] \right\} \quad (15)$$

The values for the terms in equation (15) were obtained by replacing the harvest statistics (H's) by the appropriate effort statistics (E's) in equation (11), and equation (14) was used as is in the final term of equation (15).

Total angler effort, catch, or harvest across all strata (or select combinations of strata) and the associated variances were obtained by summing (assuming independence). Standard errors were obtained by taking the square root of the variance estimates.

The necessary assumptions used to obtain unbiased point estimates of angler effort, catch, and harvest by the procedures outlined above for this survey were:

1. CPUE and HPUE are independent of the duration of fishing trip (as per DiCostanzo 1956);
2. interviewed anglers accurately report their hours of fishing effort and the number of fish released by species; and
3. the angler count process was approximately instantaneous, or that the creel clerk traveled substantially faster than anglers moved about, exited, or entered the fishery.

Additionally, the "behavior" of each fishery (at each site) was assumed to be essentially independent from the others. This assumption was necessitated by sampling the fisheries as a circuit, and would affect only the estimates of across-site totals and their variances.

We could not assess the validity of all these assumptions. It was not possible to evaluate assumption 2, although there was no reason for anglers to inaccurately report hours fished. Since the time required to sample most of the sites was short, assumption 3 was usually met.

Contributions of Coded-wire Tagged Stocks

Chinook and coho salmon sampled that had missing adipose fins were measured to the nearest 5 mm (tip of snout to fork of tail) and their heads were retained. A locking plastic strap with a unique number was inserted through the jaw. Heads and coded wire tag (CWT) recovery data were sent to the Alaska Department of Fish and Game CWT Processing Laboratory in Juneau for tag removal and decoding.

Heads were classified as "random" (randomly sampled during regularly scheduled creel sampling periods) or "select" (voluntarily provided by unsampled anglers). Only random recoveries were used to estimate CWT contributions by release group.

Hatchery contributions, associated variances, and standard errors were estimated for the creel survey using procedures outlined in Suchanek and Bingham (1990a). These procedures essentially follow the approach outlined by Clark and Bernard (1987) as modified by Conrad and Larson (1987). Due to limitations in the CWT Processing Laboratory data base structure, contributions of coho salmon were not separated into "large" and "jack" categories.

RESULTS

Sampling information, including angler counts and numbers of uncompleted and completed-trip interviews taken each day by site, is presented in Appendix A2. Overall, 1,520 angler contacts were made, of which 779 (51%) had not yet completed their fishing trips. Computer files listed in Appendix A3 contain the raw data along with associated SAS code, datasets, log, and listing files used during analysis of the data.

Detailed tables presenting effort, total catch, and harvests of the sampled roadside fisheries by area and biweekly period can be found in Appendix A4. Only a summary of the most important effort and harvest results will be presented here.

Chinook Salmon Fisheries

From an estimated total catch of 380 large and 329 small chinook salmon at Fish Creek, Auke Bay floats, and Auke Creek mouth, an estimated 282 large and 180 small chinook salmon were harvested (Table 3). The largest numbers of chinook salmon were caught at Fish Creek where 63% of the total catch and 59% of the total harvest at the three sites were taken. Angler effort at Fish Creek for the period from 24 June through 15 September was more than twice that of the Auke Bay floats and Auke Creek mouth sites combined. All anglers contacted at Fish Creek and Auke Creek mouth were targeting on salmon or Dolly Varden, but about 56% of the anglers contacted at Auke Bay floats reported targeting on bottomfish.

Chinook salmon became widely available at Fish Creek and in the Auke Bay area about 8 July and remained available until early September. Peak catches occurred from mid-July to mid-August as a total of 312 large chinook salmon (SE = 62) and 306 small chinook salmon (SE = 74) were caught during the period from 8 July through 18 August. About 74% of the large chinook salmon caught were retained in comparison to only 55% of the small chinook salmon. Retention rates declined over the course of the season as the fish darkened and became less desirable.

A total of 19 large and 11 small chinook salmon were inspected for missing adipose fins at the Auke Bay sites (Auke Bay floats and Auke Creek mouth), and 10 large and 2 small chinook salmon were found to be marked. At Fish Creek, 12 large chinook salmon out of 34 checked were marked along with 9 of 20 small chinook salmon. Contribution estimates by release group (tag code) were calculated for these two areas after heads from marked fish were recovered and tags were read (Table 4). All but one of the 13 age-.3 chinook salmon sampled from the roadside fisheries were at least 28 inches in total length, however, only 1 of 10 sampled age-.2 fish was at least 28 inches long. No age-.5 chinook salmon were sampled at the release sites from fish released in 1986. One age-.5 chinook salmon with tag code 04-26-03 (Auke Creek release) was voluntarily turned in by an angler who caught it from a boat on 7 July near the south end of Shelter Island.

Table 3. Effort, harvest, and catch statistics for Juneau roadside chinook salmon enhancement surveys by biweekly period and area during 1991.

	Biweekly period							
	24 Jun 07 Jul	08 Jul 21 Jul	22 Jul 04 Aug	05 Aug 18 Aug	19 Aug 01 Sep	02 Sep 15 Sep	Total	SE
<u>Effort (angler-hours)</u>								
Auke Bay floats	354	166	322	382	60	0	1,284	148
Auke Creek mouth	216	434	362	390	172	6	1,580	141
Fish Creek	136	1,624	2,118	2,330	1,242	400	7,850	431
Total	706	2,224	2,802	3,102	1,474	406	10,714	
SE	105	247	177	311	151	69	477	
<u>Harvest of large chinook salmon (>28")</u>								
Auke Bay floats	0	0	11	0	0	0	11	11
Auke Creek mouth	6	27	6	44	15	0	98	25
Fish Creek	0	75	17	67	10	4	173	46
Total	6	102	34	111	25	4	282	
SE	5	34	16	34	14	4	53	
<u>Harvest of small chinook salmon (<28")</u>								
Auke Bay floats	0	0	29	0	0	0	29	14
Auke Creek mouth	17	13	12	8	0	0	50	19
Fish Creek	0	61	35	5	0	0	101	27
Total	17	74	76	13	0	0	180	
SE	14	22	21	8	--	--	36	
<u>Total catch of large chinook salmon (>28")</u>								
Auke Bay floats	0	0	11	0	0	0	11	11
Auke Creek mouth	6	27	17	82	22	0	154	47
Fish Creek	0	75	17	83	21	19	215	45
Total	6	102	45	165	43	19	380	
SE	5	34	17	49	18	11	66	
<u>Total catch of small chinook salmon (<28")</u>								
Auke Bay floats	0	0	41	0	0	0	41	21
Auke Creek mouth	17	13	12	8	6	0	56	20
Fish Creek	0	91	64	77	0	0	232	70
Total	17	104	117	85	6	0	329	
SE	14	34	37	52	6	--	76	

Table 4. Estimates of hatchery-produced chinook salmon contributed to Juneau roadside sport fisheries during 1991.

Sport fishery	Hatchery	Release site	Release year	Tag code	Recov. ^a	Contr. ^b	Var. of contr. ^c		
Auke Bay area ^d	Snettisham	Auke C.	87	04-27-43	2	22	333		
			87	04-27-50	2	9	24		
			88	04-29-61	2	19	232		
			88	04-29-62	2	22	374		
			89	04-32-01	2	37	873		
	Hidden Falls ^e	Lutak I.	90	04-32-39	1	3	8		
			Subtotal		11	112	1,844		
Fish Creek	Snettisham	Fish C.	87	04-27-42	1	4	11		
			87	04-27-44	3	10	32		
			88	04-30-01	8	123	2,583		
			89	04-31-60	6	79	1,659		
		Auke Bay	88	04-29-61	1	3	---		
			89	04-32-01	1	10	90		
		Gastineau Hatchery	89	04-31-36	1	3	5		
			Subtotal		21	232	4,380		
		TOTAL					32	344	6,224

^a Recov. = number of fish recovered of noted tag code.

^b Contr. = estimated harvest of the release of the noted tag code.

^c Var. of contr. = variance of estimated harvest of the release of the noted tag code.

^d Includes sport fisheries at mouth of Auke Creek and at Auke Bay floats.

^e Hatchery operated by Northern Southeast Regional Aquaculture Association.

^f No variance could be calculated because only one recovery in a sampling stratum.

Contributions of hatchery chinook salmon by tag code for Fish Creek totaled an estimated 232 (85%) of a total harvest of 274. The estimated contribution was thought to be less than 100% due to chance, as wild stocks of chinook salmon do not return to any streams on the Juneau roadside. Some straying of hatchery stocks occurs, as two tagged chinook salmon released at Auke Bay and one from a release from the Gastineau Hatchery were taken in Fish Creek. An estimated 112 (60%) of the 188 chinook salmon harvested at the Auke Bay sites were hatchery fish. Harvests of chinook salmon at the Auke Bay sites are not necessarily all hatchery fish, as wild stocks rear throughout the marine waters of Southeast Alaska. One of the tagged chinook salmon recovered at the mouth of Auke Creek originated from a release at Lutak Inlet near Haines from Hidden Falls hatchery (owned by Northern Southeast Regional Aquaculture Association) (Table 4). It is not known if this fish was a stray or rearing in the area. All other tag codes from fish harvested in Auke Bay were from fish released at the mouth of Auke Creek. Most of the hatchery chinook salmon taken were age-.2 and age-.3 fish.

Coho Salmon Fisheries

Returns from releases of Pavlof River stock summer run coho salmon into Fish Creek began being harvested about July 9, with peak harvests in late July and early August (Table 5). The fishery for these early run fish (and returns of hatchery chinook salmon) was mostly over by about 1 September as effort dropped off greatly at this time. Harvest of coho salmon at Fish Creek through 1 September totaled 1,201 fish, and effort and harvest of coho salmon in September and October was relatively small.

An estimated 1,270 angler-hours of effort (SE = 168) were expended for coho salmon returning to the mouth of Montana Creek from 2 September to 27 October, and an estimated 491 large coho salmon were harvested from a total catch of 1,057 (Table 5). Effort was substantially less at Mendenhall Ponds from 16 September to 27 October, although an estimated 192 large coho salmon were taken from a total catch of 460. No jack coho salmon were taken at Fish Creek, but 40 (SE = 22) jack coho salmon (total catch of 149) were taken at Montana Creek mouth, and 342 (SE = 177) jack coho salmon (total catch of 465) were taken at Mendenhall Ponds (Appendix A4).

A total of 245 coho salmon harvested at Fish Creek was checked for missing adipose fins, and 218 marked fish were found. At Mendenhall Ponds, 19 of 96 coho salmon checked were marked, and 6 of 139 coho salmon checked at Montana Creek mouth were marked. After heads from marked fish were recovered and tags were read, the hatchery contributions of coho salmon to these three sites totaled 1,407 (SE = 143) (Table 6), an estimated 60% of the coho salmon harvest at these three sites. All of the contributions came from 1990 coho salmon releases (tag code 04-32-36 was released on 18 December 1989). At least some of the fish returning from releases 04-32-36 and 04-32-37 were jacks instead of large coho salmon.

Only 42 (8%) of the total harvest of 531 coho salmon (491 large and 40 jack) taken at the mouth of Montana Creek were hatchery fish originating from releases at Mendenhall Ponds. Hatchery contributions of coho salmon to the Mendenhall Ponds fishery totaled 254 (48%) of the harvest of 192 large and 342 jack coho salmon. The Fish Creek fishery was almost entirely dependent on hatchery coho salmon, as an estimated 87% (1,111) of the 1,276 large coho salmon taken were of hatchery origin. At Fish Creek, almost all recoveries of coho salmon came from releases of early run Pavlof River coho salmon stock (tag codes 4-29-53 and 4-31-

Table 5. Effort, harvest, and catch statistics for large coho salmon at sites surveyed on the Juneau roadside by biweekly period during 1991.

Site	Biweek	Effort		Large coho salmon			
		Angler-hours	SE	Harvest	SE	Total catch	SE
Fish Creek	08 Jul - 21 Jul	1,624	228	156	33	156	33
	22 Jul - 04 Aug	2,118	158	421	107	439	117
	05 Aug - 18 Aug	2,330	285	403	61	413	61
	19 Aug - 01 Sep	1,242	140	221	72	282	87
	02 Sep - 15 Sep	400	68	55	26	90	43
	16 Sep - 29 Sep	70	14	20	13	23	13
	30 Sep - 13 Oct	18	11	0	--	0	--
	14 Oct - 27 Oct	3	3	0	--	0	--
	Total	7,805	427	1,276	149	1,403	167
Montana Creek mouth	02 Sep - 15 Sep	248	127	94	51	128	59
	16 Sep - 29 Sep	785	100	312	55	685	240
	30 Sep - 13 Oct	209	45	82	22	189	45
	14 Oct - 27 Oct	28	12	3	0	55	35
	Total	1,270	168	491	78	1,057	253
Mendenhall Ponds	16 Sep - 29 Sep	127	31	42	18	54	23
	30 Sep - 13 Oct	187	44	106	27	249	121
	14 Oct - 27 Oct	78	27	44	24	157	121
	Total	392	60	192	41	460	173

Table 6. Estimates of hatchery produced coho salmon contributed to selected Juneau roadside sport fisheries during 1991.

Sport fishery	Hatchery	Release site	Release year	Tag code	Recov. ^a	Contr. ^b	Var. of contr. ^c
Montana Creek	Snettisham	Mendenhall ponds	90	04-32-37	2	29	7
	Gastineau	Mendenhall ponds	90	04-32-36	1	13	148
	Subtotal				3	42	155
Mendenhall ponds	Snettisham	Mendenhall ponds	90	04-32-37	7	30	161
	Gastineau	Mendenhall ponds	90	04-32-36	10	224	7,007
	Subtotal				17	254	7,168
Fish Creek	Snettisham	Fish Creek	90	04-29-53	155	798	10,517
			90	04-31-46	53	304	2,646
			90	04-32-35	1	9	93
			Subtotal				209
TOTAL					229	1,407	20,579

^a Recov. = number of fish recovered of noted tag code.

^b Contr. = estimated harvest of the release of the noted tag code.

^c Var. of contr. = variance of estimated harvest of the release of the noted tag code.

46). Only one recovery from late running Speel Lake stock (tag code 4-32-35) was made, and the estimated contribution was nine fish.

DISCUSSION

Validity of the Sampling Design

It was not possible to test all of the assumptions upon which the study design was based. Since anglers did fish outside the peak of the fishing day (especially during the peak of the Fish Creek fishery), our estimates of total harvest are negatively biased. Additionally, since uncompleted-trip interviews were used in the harvest estimates, it is likely that harvest estimates are further biased to some degree, especially for large coho salmon where the 2 fish bag limit in fresh water was often restrictive. Uncompleted-trip harvest rates are often negatively biased in these situations and therefore lead to underestimates of total harvest. By using the same sampling design at all of the release sites during evaluations of hatchery releases of chinook and coho salmon, however, these biases should be relatively constant, and comparisons of the values of different release sites and strategies would be valid.

The 1990 roadside studies had a very similar sampling design which also relied on uncompleted-trip interviews (Suchanek and Bingham 1991a). Estimates from these studies can be compared to estimates from Mills (1991) who also reported 1990 harvest estimates for the Juneau roadside. Mills (1991) reported a Juneau roadside freshwater harvest estimate of 34 chinook salmon and 434 coho salmon during 1990. Suchanek and Bingham (1991a) reported a harvest of 137 chinook salmon at Fish Creek and 1,104 large coho salmon, and 1,669 jack coho salmon at the combined freshwater sites (Mendenhall Ponds and Cowee, Peterson, Montana, and Fish creeks) they surveyed during 1990. It does not appear from this crude comparison that Suchanek and Bingham (1991a) seriously underestimated chinook and coho salmon harvests in fresh water on the Juneau roadside.

Chinook Salmon Fisheries

Harvests and timing of the runs of hatchery chinook salmon in 1991 were very similar to those seen during 1990 and 1989. Harvests of hatchery chinook salmon at Fish Creek again did not occur until early July. It would be desirable if hatchery chinook salmon returned to release sites in May and June when only Dolly Varden are otherwise available. By early to mid-July, returning pink and chum salmon provide additional opportunities for roadside anglers.

Since no age-.5 chinook salmon were randomly recovered from 1986 releases, Suchanek and Bingham's (1991a) evaluation of the 1986 releases remains current. Evaluation of the 1987 releases is now essentially complete, although a few age-.5 fish could again return in 1992. The 1987 releases of hatchery chinook salmon contributed to roadside fisheries as well as to the Juneau boat sport fishery and commercial fisheries (Table 7). Overall performance of the 1987 releases (1.8 chinook salmon contributed to sport fisheries per 1,000 smolts released) was not as good as for the 1986 releases (2.9 chinook salmon contributed per 1,000 smolts) (Suchanek and Bingham 1991a). The relatively smaller contributions from the 1987 releases are presumably due to a decrease in survival rates. One other factor that reduced contributions from the 1987 releases was a regulation change enacted in 1989, which eliminated the legal retention of adipose-clipped small

Table 7. Summary of contributions of hatchery chinook salmon for 1987 releases by tag code on the Juneau roadside to sport and commercial fisheries, 1988-1991.

Release information				Commercial contribution through 1991 ^d	Sport contributions ^a							Sport contribution per 1,000 smolt released
Site	Release strategy ^b	No. ^c (tag code)	Weight per fish (grams)		1989 boat	1989 roadside	1990 boat	1990 roadside	1991 boat	1991 roadside	Total	
Montana Cr.	DIR	30,703 (4-27-45)	8.4	30	0	0	20	0	0	0	20	0.6
Fish Cr.	DIR	31,479 (4-27-42)	7.6	29	6	23	4	13	0	4	50	1.6
Auke Cr.	DIR	50,522 (4-27-43)	9.1	73	0	0	9	22	0	22	53	1.0
Auke Cr.	RET	15,038 (4-27-50)	10.4	55	33 ^e	0	10	7	0	9	59	3.9
Fish Cr.	IMP	31,205 (4-27-44)	11.0	85	1	43	22	0	5	10	81	2.6
Auke Cr.	IMP	24,972 (4-27-46)	10.1	80	2	0	10	0	0	0	12	0.5
Sheep Cr.	IMP	31,112 (4-27-48)	10.6	254	10	0	92	0	5	0	107	3.4
Total				606	52	66	167	42	10	45	382	1.8
Percentage of total sport contribution					14%	17%	44%	11%	3%	12%	100%	

^a Additional sport contribution data taken from Suchanek and Bingham (1989, 1990a, 1990b, 1991a, 1991b, *In prep*).

^b DIR = direct release.

RET = retained and fed.

IMP = retained, fed, and imprinted.

^c No. = number of fish released for noted tag code.

^d Contributions to commercial fisheries obtained from FRED Division for years through 1991.

^e One fish was contributed to 1988 boat sport fishery.

chinook salmon and therefore reduced contributions of age-.2 chinook salmon to the boat sport fishery.

Performance of the 1988 releases to date (up to age-.3 returns) has been better (4.9 fish contribution per 1,000 smolts released) than that obtained from the 1986 and 1987 releases (Table 8). Smolt weights for 1988 releases were greater, which may be one factor enhancing performance. Suchanek and Bingham (1991b, *In prep*) present detailed hatchery contributions by tag code to various boat sport fisheries throughout the region. Other successful 1988 releases included a Crystal Lake release in Earl West Cove (tag code 04-30-04; average weight = 25.8 grams), which contributed at least 2.7 fish per 1,000 smolts released (total contribution of 1,325 fish) to 1990 boat sport fisheries in Juneau and Ketchikan and 1991 boat fisheries in Juneau, Ketchikan, Wrangell, Petersburg, and Sitka (even though fisheries in Wrangell, Petersburg and Sitka were not sampled extensively). Successful 1988 releases (tag codes 04-31-01 and 04-31-07) in Carroll Inlet averaged 31.4 grams in weight and contributed a total of 4.7 to 4.8 chinook salmon per 1,000 smolts released to the 1990 and 1991 Ketchikan boat sport fishery. McGee et al. (1991) present data on the performance of various releases from different chinook salmon brood stocks, and many releases with smolt weights of <10 grams have performed less successfully. Stocking of small smolts (10-12 grams or less) is probably not desirable.

Since almost all the recoveries of Montana and Sheep Creek releases were taken in the Juneau boat sport fishery (Tables 7 and 8), a roadside creel survey program is only valuable for evaluating success of Auke and Fish Creek releases. About 57% of the contribution of the Auke and Fish Creek 1988 releases were taken in the boat sport fishery, and therefore contributions to the boat sport fishery are probably an adequate index of the total performance of the tag releases. In both 1990 and 1991, an estimated 26% of all Alaska hatchery chinook salmon taken in the Juneau boat sport fishery originated from the roadside releases (Suchanek and Bingham 1991b, *In prep*). The roadside releases increased the total chinook salmon harvest in the Juneau boat fishery by about 6% to 7%.

Coho Salmon Fisheries

The roadside fisheries for coho salmon surveyed in 1991 were bolstered by harvests of an estimated 1,407 fish from 1990 releases of hatchery coho salmon at the sites (Table 6). Contributions to local roadside fisheries from returns of over 1,000,000 coho salmon smolts released at Gastineau and Sheep Creek hatcheries were not evaluated. Limited observations indicated that large returns from these releases generated the largest roadside fisheries ever seen in the Juneau area. Despite the concurrent presence of these relatively large fisheries, the 1,270 angler-hours of effort expended at Montana Creek mouth from 2 September to 27 October 1991 was greater than that seen in 1990 when 930 angler-hours were expended from 27 August through 21 October (Suchanek and Bingham 1991a). Similarly, effort at Mendenhall Ponds from 16 September through 27 October 1991 was higher than for the same period in 1990. These statistics indicate that there is a very large demand for coho salmon fisheries on the Juneau roadside.

As with chinook salmon, local releases of hatchery coho salmon contribute to boat sport fisheries as well as to the roadside fisheries (Table 9). Sport contributions from the evaluated 1990 releases of coho salmon to the 1991 fisheries totaled an estimated 1,407 fish (75%) to the roadside fisheries and 481 fish (25%) to the local boat sport fishery. Smolts released into Fish Creek in 1990 also produced substantial fisheries for jack coho salmon in 1990. At the time

Table 8. Summary of contributions of hatchery chinook salmon for 1988 releases by tag code on the Juneau roadside to sport fisheries, 1989-1991 (more contributions are expected in 1992).

Release information					Sport contributions ^a								Sport contribution per 1,000 smolt released
Site	Release strategy ^b	No. ^c	(tag code)	Weight per fish (grams)	Commercial contribution through 1991 ^d	1989 boat	1989 roadside	1990 boat	1990 roadside	1991 boat	1991 roadside	Total	
Montana Cr.	DIR	52,000	(4-26-12)	11.2	20	0	0	17	0	67	0	84	1.6
Auke Cr.	RET	46,000	(4-29-62)	14.3	169	0	0	71	11	65	22	169	3.7
Fish Cr.	IMP	74,000	(4-30-01)	13.6	267	0	83	11	137	288	123	642	8.7
Auke Cr.	IMP	46,000	(4-29-61)	14.4	189	5	26	51	30	116	22	250	5.4
Sheep Cr.	IMP	31,556	(4-30-02)	14.7	219	0	0	1	0	77	0	78	2.5
Total		249,556			864	5	109	151	178	613	167	1,223	4.9
Percentage of total sport contribution						<1%	9%	12%	15%	50%	14%	100%	

^a Additional sport contribution data taken from Suchanek and Bingham (1990a, 1990b, 1991a, 1991b, *In prep*).

^b DIR = direct release.
RET = retained and fed.
IMP = retained, fed, and imprinted.

^c No. = number of fish released for noted tag code.

^d Contributions to commercial fisheries obtained from FRED Division for years through 1991.

Table 9. Summary of contributions by tag code of hatchery coho salmon released on the Juneau roadside in 1990 to local sport fisheries in 1990 and 1991.

Release information						
Site	No. ^b (tag code)	Weight per fish (grams)	Sport contribution ^a			Contribution per 1,000 smolt released
			Roadside	Boat	Total	
1990 contributions of jack coho salmon						
Fish Creek	20,376 (4-32-35)	50.0	418	0	418	20.5
	20,860 (4-29-53)	29.0	651	0	651	31.2
	6,420 (4-31-46)	29.0	109	0	109	17.0
Mendenhall ponds	25,843 (4-32-37)	36.7	88	0	88	3.4
	100,763 (4-32-36)	9.5	0	0	0	0.0
1991 contributions of large coho salmon						
Fish Creek	20,376 (4-32-35)	50.0	9	45	54	2.7
	20,860 (4-29-53)	29.0	798	132	930	44.6
	6,420 (4-31-46)	29.0	304	52	356	55.5
Mendenhall ponds	25,843 (4-32-37)	36.7	59	46	105	4.1
	100,763 (4-32-36) ^c	9.5	237	206	443	4.4

^a Additional sport contribution data taken from Suchanek and Bingham (1991a, 1991b, *In prep*).

^b No. = number of fish released for noted tag code.

^c Contributions for this release will continue into 1992 as some of the large coho roadside contribution listed here were actually jack coho salmon.

tag code 04-32-37 was released at Mendenhall Ponds, low water blocked migration, and survival was estimated to have been extremely low (approximately 1%). Some of the "jacks" caught in 1990 from this release may have been residualized smolts.

By examining contributions of coho salmon to sport fisheries on a per-smolt-released basis, different releases may be evaluated on their effectiveness for enhancing sport fisheries (Table 9). Contributions of the release of fry into Mendenhall Ponds (tag code 04-32-36) will continue into the 1992 fisheries, so evaluation of this release is incomplete. Thus far, however, it appears that this release has been relatively successful. The other Mendenhall Ponds release (tag code 04-32-37) may also contribute a few more fish in 1992, as a jack coho salmon was recovered in 1991. Summer-run releases (tag codes 04-29-53 and 04-31-46) of coho salmon to Fish Creek were outstanding in comparison to all past releases of fall run coho salmon on the Juneau roadside (Suchanek and Bingham 1991a).

The summer-run coho salmon releases performed very well in comparison to the fall-run releases for several reasons. Commercial harvest of the fall run coho salmon release at Fish Creek (tag code 04-32-35) was 96% of the total combined sport and commercial harvest (Table 10). On the other hand, commercial harvest of the two summer run releases was an average of only 31% of the combined harvest. Since summer run coho salmon were returning to Fish Creek by mid-July, the bulk of the run was not subjected to the commercial troll fishery which often takes 40% to 45% of the total return of coho salmon (ADF&G 1989). The fish were a unique opportunity for Juneau roadside anglers to take coho salmon in July and early August, as the traditional roadside coho fishery occurs in late August, September, and October (Suchanek and Bingham 1991a). Since the Fish Creek site also had returning hatchery chinook salmon, the site was doubly attractive for anglers.

CONCLUSIONS AND RECOMMENDATIONS

Enhancement efforts have led to increases in the harvests of chinook and coho salmon on the Juneau roadside, however, the success of the program has been mixed. These enhancement efforts are costly and creel survey programs have proved instrumental in documenting the success of these programs. In addition, these survey programs also provide valuable information for public education, proposed regulatory changes, comments on Environmental Impact Statements, and baseline data on the fisheries.

During 1991, harvest sampling programs showed that Juneau roadside anglers benefitted most greatly from a stocking of summer run coho salmon into Fish Creek. The summer run coho salmon performed extremely well in comparison to past releases of fall run coho salmon. Evaluation of Federal Aid funded stocking of coho salmon is now over, and further evaluation of Juneau roadside releases of chinook salmon can probably be adequately accomplished through monitoring the boat sport fishery in 1992. A comprehensive roadside creel survey scheduled for 1993 will provide information on all local enhancement efforts along with wild stock harvests.

Table 10. Comparison of 1991 commercial and sport contributions by tag code for selected 1990 releases of hatchery coho salmon on the Juneau roadside.

Tag code	Number released	Total commercial contribution ^a	Contributions per 1,000 smolts released		
			Commercial (%)	Sport (%) ^b	Total
<u>Summer-run stocks released at Fish Creek</u>					
04-29-53	20,860	442	21.2 (32%)	44.6 (68%)	65.8
04-31-46	6,420	123	19.2 (26%)	55.5 (64%)	74.6
Subtotal	27,280	565	20.7 (31%)	47.1 (69%)	67.9
<u>Fall-run stocks released at Fish Creek or Mendenhall Ponds</u>					
04-32-35	20,376	1,146	56.2 (96%)	2.7 (4%)	58.9
04-32-37	25,843	379	14.7 (78%)	4.1 (22%)	18.7
04-32-36	100,763	1,929	19.1 (81%)	4.4 (19%)	23.5
Subtotal	146,982	3,454	23.5 (85%)	4.1 (15%)	27.6

^a Commercial contributions for 1991 obtained from FRED Division tag lab.

^b Additional sport contribution data taken from Suchanek and Bingham (*In prep*).

ACKNOWLEDGMENTS

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APPENDIX A

Auke Bay floats: Saltwater fishery which occurs from docks in head of Auke Bay including Government Dock and Auke Bay launch ramp.

Auke Creek mouth: Located at the head of Auke Bay. Fishery occurs in salt water near the mouth of the creek as the creek itself is closed to fishing. Shore anglers were counted on the beach within 200 yards of the mouth.

Montana Creek mouth: Creek flows into the Mendenhall River one mile upstream from the Brotherhood Bridge. The mouth of the creek includes waters upstream approximately 200 yards and waters approximately 100 yards downstream in the Mendenhall River.

Mendenhall Ponds: This system of small lakes is located north of the Mendenhall Back Loop Bridge, east of the Mendenhall River, and south of Mendenhall Lake (the ponds drain into the Mendenhall River). Fishing occurs primarily in the holding pond, outlet of holding pond, and in nearby Moose Lake, and these were the only areas of the system surveyed. This site has been referred to in some previous reports as Dredge Lakes.

Fish Creek: Creek flows into Fritz Cove on north end of Douglas Island. The fishery occurs primarily in an attached pond subjected to tidal influence about 100 meters downstream of the bridge, although anglers encountered from the pond to about 100 yards upstream of the North Douglas Highway bridge were interviewed. Some fishing also occurred in an area defined as salt water downstream of the pond.

Appendix A2.

Listing of numbers of anglers counted and interviewed by site and date for sites surveyed on the Juneau roadside during 1991.

Sample date	Stratum ^a	Sampling period	Count number			Anglers interviewed		
			1st	2nd	3rd	Inc.	Comp.	Total
<u>Auke Bay floats</u>								
25JUN91	WD	10:00-18:00	0	5	5	0	7	7
26JUN91	WD	10:00-18:00	1	2	6	0	9	9
29JUN91	WE/H	10:00-18:00	2	5	2	1	8	9
30JUN91	WE/H	8:00-16:00	0	2	2	1	3	4
02JUL91	WD	8:00-16:00	0	0	2	0	1	1
05JUL91	WD	10:00-18:00	2	2	2	0	4	4
06JUL91	WE/H	10:00-18:00	0	3	0	0	3	3
07JUL91	WE/H	8:00-16:00	0	3	2	0	5	5
09JUL91	WD	8:00-16:00	1	5	1	3	4	7
12JUL91	WD	8:00-16:00	0	1	0	1	0	1
13JUL91	WE/H	8:00-16:00	0	0	2	1	1	2
14JUL91	WE/H	8:00-16:00	0	4	0	1	1	2
15JUL91	WD	10:00-18:00	0	3	0	2	0	2
18JUL91	WD	10:00-18:00	0	0	0	0	0	0
20JUL91	WE/H	8:00-16:00	1	0	2	0	3	3
21JUL91	WE/H	10:00-18:00	1	2	2	0	4	4
23JUL91	WD	10:00-18:00	0	0	2	0	2	2
24JUL91	WD	8:00-16:00	0	5	0	0	5	5
27JUL91	WE/H	8:00-16:00	0	0	0	0	0	0
28JUL91	WE/H	8:00-16:00	0	1	0	1	0	1
29JUL91	WD	10:00-18:00	2	3	3	1	6	7
30JUL91	WD	10:00-18:00	2	5	3	0	4	4
03AUG91	WE/H	10:00-18:00	2	0	4	1	5	6
04AUG91	WE/H	10:00-18:00	3	2	6	4	4	8
06AUG91	WD	10:00-18:00	7	6	4	3	6	9
07AUG91	WD	10:00-18:00	0	3	3	2	3	5
10AUG91	WE/H	8:00-16:00	0	1	1	0	2	2
13AUG91	WD	8:00-16:00	0	4	4	5	3	8
15AUG91	WD	10:00-18:00	0	4	0	0	3	3
17AUG91	WE/H	8:00-16:00	0	0	2	0	2	2
19AUG91	WD	8:00-16:00	0	0	0	0	0	0
22AUG91	WD	8:00-16:00	0	0	0	0	0	0
24AUG91	WE/H	10:00-18:00	2	1	0	0	3	3
25AUG91	WE/H	8:00-16:00	0	0	0	0	0	0
26AUG91	WD	8:00-16:00	0	2	0	2	0	2
30AUG91	WD	8:00-16:00	0	0	0	0	0	0
31AUG91	WE/H	8:00-16:00	0	0	0	0	0	0
01SEP91	WE/H	10:00-18:00	2	5	0	0	6	6
02SEP91	WD	10:00-18:00	0	0	0	0	0	0
04SEP91	WD	8:00-16:00	0	0	0	0	0	0
06SEP91	WD	10:00-18:00	0	0	0	0	0	0
07SEP91	WE/H	8:00-16:00	0	0	0	0	0	0

- continued -

Sample date	Stratum ^a	Sampling period	Count number			Anglers interviewed		
			1st	2nd	3rd	Inc.	Comp.	Total
<u>Auke Creek mouth</u>								
25JUN91	WD	10:00-18:00	0	2	0	0	2	2
26JUN91	WD	10:00-18:00	0	0	0	0	0	0
29JUN91	WE/H	10:00-18:00	0	0	1	0	1	1
30JUN91	WE/H	8:00-16:00	0	1	4	2	3	5
02JUL91	WD	8:00-16:00	0	0	2	0	2	2
05JUL91	WD	10:00-18:00	0	2	1	0	3	3
06JUL91	WE/H	10:00-18:00	1	3	5	1	4	5
07JUL91	WE/H	8:00-16:00	0	11	2	1	5	6
09JUL91	WD	8:00-16:00	0	0	2	1	2	3
12JUL91	WD	8:00-16:00	2	3	2	4	3	7
13JUL91	WE/H	8:00-16:00	2	2	5	3	4	7
14JUL91	WE/H	8:00-16:00	0	4	0	1	3	4
15JUL91	WD	10:00-18:00	2	3	4	2	3	5
18JUL91	WD	10:00-18:00	2	5	0	1	5	6
20JUL91	WE/H	8:00-16:00	2	6	11	10	2	12
21JUL91	WE/H	10:00-18:00	4	7	3	4	8	12
23JUL91	WD	10:00-18:00	0	2	1	3	0	3
24JUL91	WD	8:00-16:00	0	1	0	1	1	2
27JUL91	WE/H	8:00-16:00	3	3	5	2	5	7
28JUL91	WE/H	8:00-16:00	0	0	2	2	0	2
29JUL91	WD	10:00-18:00	4	0	5	4	5	9
30JUL91	WD	10:00-18:00	8	4	0	3	7	10
03AUG91	WE/H	10:00-18:00	1	2	2	2	2	4
04AUG91	WE/H	10:00-18:00	3	3	4	3	4	7
06AUG91	WD	10:00-18:00	2	0	5	6	3	9
07AUG91	WD	10:00-18:00	2	0	3	5	1	6
10AUG91	WE/H	8:00-16:00	0	2	4	0	7	7
13AUG91	WD	8:00-16:00	0	2	0	2	0	2
15AUG91	WD	10:00-18:00	3	2	4	5	3	8
17AUG91	WE/H	8:00-16:00	3	5	6	7	6	13
19AUG91	WD	8:00-16:00	2	0	4	3	2	5
22AUG91	WD	8:00-16:00	0	0	4	0	3	3
24AUG91	WE/H	10:00-18:00	2	3	1	0	5	5
25AUG91	WE/H	8:00-16:00	6	0	1	2	5	7
26AUG91	WD	8:00-16:00	2	0	0	0	2	2
30AUG91	WD	8:00-16:00	0	0	0	0	0	0
31AUG91	WE/H	8:00-16:00	0	0	0	0	0	0
01SEP91	WE/H	10:00-18:00	0	0	0	0	0	0
02SEP91	WD	10:00-18:00	0	1	0	1	0	1
04SEP91	WD	8:00-16:00	0	0	0	0	0	0
06SEP91	WD	10:00-18:00	0	0	0	0	0	0
07SEP91	WE/H	8:00-16:00	0	0	0	0	0	0
<u>Fish Creek</u>								
25JUN91	WD	10:00-18:00	0	0	0	0	0	0
26JUN91	WD	10:00-18:00	1	1	1	1	2	3
29JUN91	WE/H	10:00-18:00	0	2	2	0	4	4
30JUN91	WE/H	8:00-16:00	1	9	1	5	5	10

-continued-

Sample date	Stratum ^a	Sampling period	Count number			Anglers interviewed		
			1st	2nd	3rd	Inc.	Comp.	Total
<u>Fish Creek (continued)</u>								
02JUL91	WD	8:00-16:00	0	0	0	0	0	0
05JUL91	WD	10:00-18:00	0	1	1	1	0	1
06JUL91	WE/H	10:00-18:00	0	0	0	0	0	0
07JUL91	WE/H	8:00-16:00	0	5	0	2	3	5
09JUL91	WD	8:00-16:00	0	3	2	1	5	6
12JUL91	WD	8:00-16:00	3	7	7	6	13	19
13JUL91	WE/H	8:00-16:00	9	22	13	10	12	22
14JUL91	WE/H	8:00-16:00	16	24	25	20	16	36
15JUL91	WD	10:00-18:00	13	15	19	10	17	27
18JUL91	WD	10:00-18:00	5	7	11	9	7	16
20JUL91	WE/H	8:00-16:00	17	9	12	15	16	31
21JUL91	WE/H	10:00-18:00	7	16	6	14	13	27
23JUL91	WD	10:00-18:00	10	9	7	9	13	22
24JUL91	WD	8:00-16:00	3	17	11	10	14	24
27JUL91	WE/H	8:00-16:00	2	12	26	4	9	13
28JUL91	WE/H	8:00-16:00	7	23	26	17	19	36
29JUL91	WD	10:00-18:00	12	14	13	20	11	31
30JUL91	WD	10:00-18:00	13	14	20	25	12	37
03AUG91	WE/H	10:00-18:00	9	14	13	19	16	35
04AUG91	WE/H	10:00-18:00	11	22	7	18	14	32
06AUG91	WD	10:00-18:00	19	11	25	21	18	39
07AUG91	WD	10:00-18:00	5	17	10	12	14	26
10AUG91	WE/H	8:00-16:00	11	20	20	20	11	31
13AUG91	WD	8:00-16:00	5	12	31	13	13	26
15AUG91	WD	10:00-18:00	10	6	18	15	12	27
17AUG91	WE/H	8:00-16:00	7	5	16	10	12	22
18AUG91	WE/H	8:00-16:00	8	18	4	17	4	21
19AUG91	WD	8:00-16:00	1	1	12	3	8	11
22AUG91	WD	8:00-16:00	5	7	11	13	10	23
24AUG91	WE/H	10:00-18:00	10	16	7	12	15	27
25AUG91	WE/H	8:00-16:00	3	10	22	19	5	24
26AUG91	WD	8:00-16:00	2	8	11	6	12	18
30AUG91	WD	8:00-16:00	1	4	16	9	7	16
31AUG91	WE/H	8:00-16:00	1	7	9	7	6	13
01SEP91	WE/H	10:00-18:00	5	10	13	15	9	24
02SEP91	WD	10:00-18:00	4	7	8	12	5	17
04SEP91	WD	8:00-16:00	2	4	4	5	4	9
06SEP91	WD	10:00-18:00	3	6	3	8	1	9
07SEP91	WE/H	8:00-16:00	1	5	0	3	3	6
09SEP91	WD	10:00-18:00	0	0	0	0	0	0
13SEP91	WD	10:00-18:00	0	0	3	3	0	3
14SEP91	WE/H	10:00-18:00	2	1	4	6	1	7
15SEP91	WE/H	10:00-18:00	3	0	1	0	3	3
16SEP91	WD	8:00-15:20	1	0	0	0	1	1
19SEP91	WD	8:00-15:20	0	0	0	0	0	0
21SEP91	WE/H	8:00-15:20	1	1	1	1	2	3
22SEP91	WE/H	8:00-15:20	1	1	0	1	0	1
24SEP91	WD	8:00-15:20	1	1	0	0	2	2
27SEP91	WD	8:00-15:20	0	0	1	1	0	1

-continued-

Sample date	Stratum ^a	Sampling period	Count number			Anglers interviewed		
			1st	2nd	3rd	Inc.	Comp.	Total
<u>Fish Creek (continued)</u>								
28SEP91	WE/H	8:00-15:20	1	1	1	1	2	3
29SEP91	WE/H	8:00-15:20	0	0	1	1	0	1
30SEP91	WD	8:00-15:20	0	0	0	0	0	0
02OCT91	WD	8:00-15:20	0	0	0	0	0	0
05OCT91	WE/H	8:00-15:20	0	0	0	0	0	0
06OCT91	WE/H	8:00-15:20	1	2	0	1	1	2
08OCT91	WD	8:00-14:40	0	0	0	0	0	0
09OCT91	WD	8:00-14:40	0	1	0	0	1	1
12OCT91	WE/H	8:00-14:40	0	0	0	2	0	2
13OCT91	WE/H	8:00-14:40	0	0	0	0	0	0
16OCT91	WD	8:00-14:40	0	0	0	0	0	0
18OCT91	WD	8:00-14:40	0	0	0	0	0	0
19OCT91	WE/H	8:00-14:40	0	0	0	0	0	0
20OCT91	WE/H	8:00-14:40	0	0	1	2	0	2
22OCT91	WD	8:00-14:40	0	0	0	0	0	0
25OCT91	WD	8:00-14:40	0	0	0	0	0	0
26OCT91	WE/H	8:00-14:40	0	0	0	0	0	0
27OCT91	WE/H	8:00-14:40	0	0	0	0	0	0
<u>Montana Creek mouth</u>								
09SEP91	WD	10:00-18:00	1	0	0	0	1	1
13SEP91	WD	10:00-18:00	5	5	7	4	9	13
14SEP91	WE/H	10:00-18:00	4	0	1	3	3	6
15SEP91	WE/H	10:00-18:00	4	7	1	9	4	13
16SEP91	WD	8:00-15:20	6	4	5	8	4	12
19SEP91	WD	8:00-15:20	0	1	9	7	2	9
21SEP91	WE/H	8:00-15:20	9	4	7	11	10	21
22SEP91	WE/H	8:00-15:20	7	5	10	17	0	17
24SEP91	WD	8:00-15:20	6	1	2	3	4	7
27SEP91	WD	8:00-15:20	4	4	10	7	5	12
28SEP91	WE/H	8:00-15:20	11	5	9	13	5	18
29SEP91	WE/H	8:00-15:20	8	5	4	11	3	14
30SEP91	WD	8:00-15:20	2	2	1	3	2	5
02OCT91	WD	8:00-15:20	1	0	5	4	4	8
05OCT91	WE/H	8:00-15:20	1	4	0	6	5	11
06OCT91	WE/H	8:00-15:20	3	2	0	3	5	8
08OCT91	WD	8:00-14:40	2	0	0	3	2	5
09OCT91	WD	8:00-14:40	0	0	5	2	5	7
12OCT91	WE/H	8:00-14:40	1	1	1	0	3	3
13OCT91	WE/H	8:00-14:40	0	2	0	3	0	3
16OCT91	WD	8:00-14:40	0	1	0	3	0	3
18OCT91	WD	8:00-14:40	0	0	1	1	1	2
19OCT91	WE/H	8:00-14:40	0	0	0	0	0	0
20OCT91	WE/H	8:00-14:40	1	0	0	2	1	3
22OCT91	WD	8:00-14:40	0	0	1	1	0	1
25OCT91	WD	8:00-14:40	0	0	0	0	0	0
26OCT91	WE/H	8:00-14:40	0	0	0	0	0	0
27OCT91	WE/H	8:00-14:40	0	0	0	0	0	0

-continued-

Sample date	Stratum ^a	Sampling period	Count number			Anglers interviewed		
			1st	2nd	3rd	Inc.	Comp.	Total
<u>Mendenhall Ponds</u>								
16SEP91	WD	8:00-15:20	0	0	0	0	0	0
19SEP91	WD	8:00-15:20	0	0	1	0	1	1
21SEP91	WE/H	8:00-15:20	0	2	1	1	2	3
22SEP91	WE/H	8:00-15:20	0	2	3	4	0	4
24SEP91	WD	8:00-15:20	2	0	0	1	1	2
27SEP91	WD	8:00-15:20	0	0	4	3	0	3
28SEP91	WE/H	8:00-15:20	2	1	3	3	2	5
29SEP91	WE/H	8:00-15:20	1	2	0	1	2	3
30SEP91	WD	8:00-15:20	0	0	0	0	0	0
02OCT91	WD	8:00-15:20	1	2	1	1	3	4
05OCT91	WE/H	8:00-15:20	3	2	5	7	6	13
06OCT91	WE/H	8:00-15:20	3	4	1	3	7	10
08OCT91	WD	8:00-14:40	1	0	0	1	1	2
09OCT91	WD	8:00-14:40	3	0	0	7	0	7
12OCT91	WE/H	8:00-14:40	3	1	3	6	6	12
13OCT91	WE/H	8:00-14:40	7	0	3	0	8	8
16OCT91	WD	8:00-14:40	1	0	3	0	4	4
18OCT91	WD	8:00-14:40	0	0	1	4	1	5
19OCT91	WE/H	8:00-14:40	0	0	0	0	0	0
20OCT91	WE/H	8:00-14:40	1	4	6	2	10	12
22OCT91	WD	8:00-14:40	0	0	0	0	0	0
25OCT91	WD	8:00-14:40	0	0	0	0	0	0
26OCT91	WE/H	8:00-14:40	0	0	0	0	0	0
27OCT91	WE/H	8:00-14:40	0	0	0	0	0	0

^a WD = weekdays (Mondays-Fridays, except 4 July and 2 September)

WE/H = weekend-holidays (Saturdays, Sundays, 4 July, and 2 September).

Appendix A3. Major computer files used for data analysis of 1991 Juneau roadside harvest data.

File	Description
<u>Data files:</u>	
c91jrs.dta	Raw mark-sense interview data files
jrs91.sas	SAS code to input interview data to a SAS dataset
jrs91msa.ssd	SAS dataset with CPUE and HPUE data
jrs91hcl.ssd	SAS dataset with count information
jrs91msa.lst	Listing of sampling information
<u>Harvest estimate analysis:</u>	
jrs91lesb.sas	Harvest estimate program
jrs91__e.bot	Input data to jrs91lesb.sas (one for each species - KS, KI, SS, etc.)
jrs91__e.lst	Listing of harvest estimates for each species from program above
<u>Hatchery contribution analysis:</u>	
Sportbas.dta	Individual listings of tag recoveries
Sportcon.dta	Individual listings of sampling information
jrw91vbn.sas	Formats data files for hatchery contribution estimates.
jrw91vbn.lst	Listing of harvest estimates, number of fish sampled, and variances by sampling strata.
jrw91vbn.ssd	SAS data set of above data.
jrn91cwt.sas	Calculates hatchery contributions using sport.con, sport.bas, and jrw91vbn.ssd
jrn91cwt.ssd	SAS dataset formed by jrn91cwt.sas
jrn91cwt.lst	Listing of hatchery contributions by tagging recoveries
jrn91cwp.doc	Listing of hatchery contribution estimates by species and site.

Appendix A4. Effort, total catch, and harvest statistics for sites located on the Juneau roadside by biweekly period during 1991.

			Biweekly Period									
			6/24- 7/07	7/08- 7/21	7/22- 8/04	8/05- 8/18	8/19- 9/01	9/02- 9/15	9/16- 9/29	9/30- 10/13	10/14- 10/27	Total
<u>Auke Bay Floats</u>												
Angler-hours of effort		Estimate	354	166	322	382	60	0				1,284
		Variance	2,744	4,764	3,288	10,200	912	0				21,908
Large chinook salmon (>28")	Catch	Estimate	0	0	11	0	0	0				11
		Variance	0	0	125	0	0	0				125
	Harvest	Estimate	0	0	11	0	0	0				11
		Variance	0	0	125	0	0	0				125
Small chinook salmon (<28")	Catch	Estimate	0	0	41	0	0	0				41
		Variance	0	0	422	0	0	0				422
	Harvest	Estimate	0	0	29	0	0	0				29
		Variance	0	0	183	0	0	0				183
Dolly Varden	Catch	Estimate	24	0	0	0	0	0				24
		Variance	261	0	0	0	0	0				261
	Harvest	Estimate	24	0	0	0	0	0				24
		Variance	261	0	0	0	0	0				261
<u>Auke Creek Mouth</u>												
Angler-hours of effort		Estimate	216	434	362	390	172	6				1,580
		Variance	4,832	4,284	3,300	5,142	2,184	48				19,790
Large chinook salmon (>28")	Catch	Estimate	6	27	17	82	22	0				154
		Variance	30	195	76	1,742	130	0				2,173
	Harvest	Estimate	6	27	6	44	15	0				98
		Variance	30	195	37	255	117	0				634
Small chinook salmon (<28")	Catch	Estimate	17	13	12	8	6	0				56
		Variance	194	26	72	54	35	0				381
	Harvest	Estimate	17	13	12	8	0	0				50
		Variance	194	26	72	54	0	0				346
Large coho salmon (>16")	Catch	Estimate	0	0	15	0	0	0				15
		Variance	0	0	143	0	0	0				143
	Harvest	Estimate	0	0	9	0	0	0				9
		Variance	0	0	49	0	0	0				49
Pink salmon	Catch	Estimate	17	89	108	148	49	0				411
		Variance	96	794	1,658	754	965	0				4,267
	Harvest	Estimate	17	89	39	92	30	0				267
		Variance	96	794	228	636	669	0				2,423
Chum salmon	Catch	Estimate	0	0	0	3	0	0				3
		Variance	0	0	0	5	0	0				5
	Harvest	Estimate	0	0	0	3	0	0				3
		Variance	0	0	0	5	0	0				5
Dolly Varden	Catch	Estimate	17	4	7	0	0	0				28
		Variance	196	12	45	0	0	0				253
	Harvest	Estimate	0	4	7	0	0	0				11
		Variance	0	12	45	0	0	0				57

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			Biweekly Period									
			6/24- 7/07	7/08- 7/21	7/22- 8/04	8/05- 8/18	8/19- 9/01	9/02- 9/15	9/16- 9/29	9/30- 10/13	10/14- 10/27	Total
<u>Auke Creek Mouth</u> (continued)												
Cutthroat trout	Catch	Estimate	8	4	8	0	0	0				20
		Variance	81	19	53	0	0	0				153
	Harvest	Estimate	0	4	0	0	0	0				4
		Variance	0	19	0	0	0	0				19
Sockeye salmon	Catch	Estimate	0	65	177	12	0	0				254
		Variance	0	764	2,046	71	0	0				2,881
	Harvest	Estimate	0	5	0	0	0	0				5
		Variance	0	36	0	0	0	0				36
<u>Fish Creek</u>												
Angler-hours of effort	Estimate		136	1,624	2,118	2,330	1,242	400	70	18		7,941
	Variance		3,476	52,008	24,906	81,186	19,638	4,652	197	125	8	186,196
Large chinook salmon (>28")	Catch	Estimate	0	75	17	83	21	19	0	0	0	215
		Variance	0	994	88	663	186	129	0	0	0	2,060
	Harvest	Estimate	0	75	17	67	10	4	0	0	0	173
		Variance	0	994	88	931	66	14	0	0	0	2,093
Small chinook salmon (<28")	Catch	Estimate	0	91	64	77	0	0	0	0	0	232
		Variance	0	1,105	1,181	2,616	0	0	0	0	0	4,902
	Harvest	Estimate	0	61	35	5	0	0	0	0	0	101
		Variance	0	467	258	15	0	0	0	0	0	740
Large coho salmon (>16")	Catch	Estimate	0	156	439	413	282	90	23	0	0	1,403
		Variance	0	1,057	13,645	3,711	7,511	1,812	179	0	0	27,915
	Harvest	Estimate	0	156	421	403	221	55	20	0	0	1,276
		Variance	0	1,057	11,429	3,742	5,222	681	178	0	0	22,309
Pink salmon	Catch	Estimate	0	105	467	273	226	119	0	0	0	1,190
		Variance	0	1,436	13,333	4,581	8,295	2,578	0	0	0	30,223
	Harvest	Estimate	0	83	192	114	63	5	0	0	0	457
		Variance	0	1,163	2,807	795	1,317	28	0	0	0	6,110
Chum salmon	Catch	Estimate	0	55	271	86	0	0	0	0	0	412
		Variance	0	901	7,160	1,055	0	0	0	0	0	9,116
	Harvest	Estimate	0	46	78	0	0	0	0	0	0	124
		Variance	0	867	1,399	0	0	0	0	0	0	2,266
Dolly Varden	Catch	Estimate	20	187	624	181	67	17	0	0	0	1,096
		Variance	167	6,536	176,754	4,018	411	140	0	0	0	188,026
	Harvest	Estimate	0	69	188	81	14	0	0	0	0	352
		Variance	0	1,046	8,709	425	50	0	0	0	0	10,230
Cutthroat trout	Catch	Estimate	8	11	19	22	8	0	4	0	0	72
		Variance	60	124	159	167	35	0	23	0	0	568
	Harvest	Estimate	0	0	13	22	8	0	0	0	0	43
		Variance	0	0	89	167	35	0	0	0	0	291

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			Biweekly Period									
			6/24- 7/07	7/08- 7/21	7/22- 8/04	8/05- 8/18	8/19- 9/01	9/02- 9/15	9/16- 9/29	9/30- 10/13	10/14- 10/27	Total
<u>Montana Creek Mouth</u>												
Angler-hours of effort	Estimate							248	785	209	28	1,270
	Variance							16,254	9,932	2,027	133	28,346
Large coho salmon (>16")	Catch	Estimate						128	685	189	55	1,057
		Variance						3,526	57,384	2,005	1,201	64,116
	Harvest	Estimate						94	312	82	3	491
		Variance						2,594	2,979	506	0	6,079
Small coho salmon (<16")	Catch	Estimate						21	116	12	0	149
		Variance						201	1,283	107	0	1,591
	Harvest	Estimate						13	27	0	0	40
		Variance						104	383	0	0	487
Dolly Varden	Catch	Estimate						71	86	13	2	172
		Variance						3,599	1,141	29	4	4,773
	Harvest	Estimate						22	12	0	2	36
		Variance						516	56	0	4	576
Cutthroat trout	Catch	Estimate						47	22	19	2	90
		Variance						1,756	160	142	3	2,061
	Harvest	Estimate						11	6	2	0	19
		Variance						129	32	4	0	165
<u>Mendenhall Ponds</u>												
Angler-hours of effort	Estimate							127	187	78		392
	Variance							983	1,949	713		3,645
Large coho salmon (>16")	Catch	Estimate						54	249	157		460
		Variance						522	14,685	14,677		29,884
	Harvest	Estimate						42	106	44		192
		Variance						317	743	598		1,658
Small coho salmon (<16")	Catch	Estimate						336	127	2		465
		Variance						37,948	5,596	5		43,549
	Harvest	Estimate						285	57	0		342
		Variance						29,043	2,260	0		31,303
Dolly Varden	Catch	Estimate						15	11	6		32
		Variance						91	52	25		168
	Harvest	Estimate						4	4	4		12
		Variance						9	8	20		37
Cutthroat trout	Catch	Estimate						24	6	0		30
		Variance						598	12	0		610
	Harvest	Estimate						24	4	0		28
		Variance						598	8	0		606